1.0 INTRODUCTION

Cricket is one of the most popular sport in India and many school level athletes are adopting it as a career. Though cricket is a safe sport with a relatively low overall player injury rate but the demands placed on the cricketer are further increased because of the repetitive nature of the game, often for long periods of time. In fact, in the past, cricket in most countries was played solely during the summer months, but its popularity has increased so much that it has lost its 'season' and is now being played throughout the year. Because of the longer season, cricket players are exposed to more demanding schedules, with more time spent training and practicing. This increase in workload is associated with a risk of injury and number of studies have documented the incidence of injury amongst both junior and senior players (Finch, Valuri&Ozanne-Smith, 1998; Leary & White, 2000; Stretch, 1993; Stretch, 2003).

Looking at the demand placed on the sportsperson specialists from many countries agree that sport preparation is a holistic and multiannual process, during which the athlete aims to achieve his or her top performance. Therefore, coaches and trainers are of the view to implement periodization in training athletes. Periodization is the systematic planning of long-term training, which is broken down further into planned training cycles such as micro, meso and macrocycles. These cycles move through phases, which work towards various goals, structures and content of a planned training programme. These cycles are sequenced in such a way that training replicates and produces the optimal time for an athlete to achieve maximal results. Periodization is the planned process of dividing an annual training plan into specific time blocks (phases), where each phase has a particular goal. Moving through these phases, this will allow you to programme varying amounts of stress that is exerted on an athlete or team to bring about maximal strength goals but also to facilitate recovery (regeneration).

In this context, during macro cycle of periodization, yoga seems to be best choice for cricketers. In fact, yoga and meditation have been found to be effective in improving physical fitness (Bera, Gore & Oak, 1998;Polsgrove, Eggleston & Lockyer, 2016; Tiedemann, O'Rourke, Sesto & Sherrington, 2013; Tran, Holly, Lashbrook& Amsterdam, 2001) as well as psychological health (Bonura, 2011; Woodyard, 2011; Ospina *et al*., 2007; Li & Goldsmith, 2012; Narasimhan, Nagarathna& Nagendra, 2011; Ospina *et al*., 2007) amongst varied population. Although, yoga training is implemented in various sports however, there is dearth of reports exploring yoga and meditation during macro cycle of periodization in school level cricket players. therefore, researcher has planned this study to find out the efficacy of yoga meditation in heart rate variability, sleep quality and stress recovery of cricket players.

1.1 Statement of Problem

Athletes in many sports face long competitive seasons, sometimes up to a year in duration, with the difficulties in achieving and maintaining peak performances over such periods of time well recognized (Duthie, Pyne, & Hooper, 2003; Kraemer *et al*., 2000). Such seasons are also often compounded by a heavy travel schedule, involving long flights and travel across multiple time zones. Therefore, athlete physical and mental preparedness can often be compromised by the fatigue that these factors impart. Accordingly, coaches and performance staff employ training periodization strategies in order to reduce this accumulated burden and ensure their athletes are prepared to perform optimally on a weekly basis (Gamble, 2006; Pyne*et al*., 2000).

Periodization has traditionally been defined as the implementation of planned changes in acute training variables with the aim of optimizing and/or maintaining gains in athletic performance (Fleck, 2011). In the competitive sport environment specifically, the aim of peaking for matches or events of perceived greatest priority or difficulty is facilitated through a process known as "tactical periodization" (Crespo, 2011; Kelly & Coutts, 2007; Porta & Sands, 2005). For example, coaches may seek to vary the volume and intensity of training on a

week-to-week basis in order to optimize athlete preparedness for the upcoming match. This form of periodization is particularly useful in team sports, in that it also considers elements of preparation such as skill, strategy and tactical training, in addition to the physical loading imparted by fitness work, travel effects and cumulative fatigue throughout the season.

The literature provides good justification for the consideration of periodization in training in school level cricket players. It has been found that the players are under tremendous stress to maintain performance during competition. Therefore, there is need to develop a training program which will benefit the players to overcome the stress and recover from injuries during micro cycle of periodization. Earlier studies have shown that yoga and meditation techniques are beneficial to improve physical fitness (Thangavel*et al*., 2014; Sengupta, 2012; Tran *et al*. 2001), concentration and reduction in stress (Chong *et al*., 2011; Malthi& Damodaran, 1999; Vempati&Telles, 2002; Rocha *et al*., 2012; Godse, Shejwal& Godse, 2015). Therefore, researcher has undertaken this study entitled **"Effect yoga meditation on heart rate variability, sleep quality and stress recovery of school level cricket players during macro cycle of periodization."**

1.2 Problem and Its Relevance

Cricket is a global sport traditionally popular in the commonwealth nations but now being played in 105 member countries of the International Cricket Council. Cricket is the world's second-most popular spectator sport after football and has captivated people of every age, sex, background, and ability for more than 400 years. A bat-and-ball game with complex rules, cricket involves physical fitness, skill, and strategy.

Although cricket is a noncontact sport, overuse and impact injuries are common since players engage in a wide range of physical activities, including running, throwing, batting, bowling, catching, jumping, and diving. Injuries in

cricket are common, particularly to fast bowlers (Finch, Elliot & McGrath, 1999; Stretch, 2003; Leary & White, 2000). According to van Mechelenetal (1992) ongoing injury surveillance is a fundamental process behind successful injury prevention. Traditionally cricket is played for approximately six months of the year, with this six month period being referred to as a ‘‘season’’. International teams now play cricket for many more than six months of the year, and, although domestic seasons do not last for longer than six months, some domestic players will play two different seasons in different countries during a 12 month period. This indicates that players do not get time to recover and hence, there is need to develop a training program which will be effective for cricket players to recover from stress during micro cycle of periodization. Therefore, researcher has planned to introduce yoga meditation program during micro cycle of periodization which could be effective for school level cricket players. Yoga meditation is an ancient Indian system of philosophy and practice (Iyengar, 1993) and found to be effective in improving mental health (Chiesa &Serretti, 2009; Goyal *et al*., 2014; Keng, Smoski& Robins, 2011), attention (Jha, Krompinger&Baime, 2007; MacLean *et al*., 2010) and emotional self-regulation (Robins, Keng, Ekblad& Brantley, 2012). Despite persistent findings indicating beneficial effects of yoga and meditation, there are very few studies conducted on sports person. therefore, present study was undertaken with a view to find out the efficacy of yoga and meditation practice on stress recovery in school level cricket players.

1.3 Objectives of the Study

- To measure the heart rate variability, sleep quality and stress recovery among the selected school level cricket players.
- To prepare and develop yoga meditation programme for school level cricket players.
- To evaluate the efficacy of yoga meditation programmeon heart rate variability, sleep quality and stress recovery.

1.4 Hypotheses

Since there is limited research on yoga in relation to cricket, the researcher hypothesized that-

HO_1: During pre-season, the yoga meditation training programme may not improve heart rate variability, sleep quality and stress recovery among the school level elite cricket players.

HO_2: During competitive-season, the yoga meditation training programme may not improve heart rate variability, sleep quality and stress recovery among the school level elite cricket players.

HO_3: During off-season, the yoga meditation training programme may not improve heart rate variability, sleep quality and stress recovery among the school level elite cricket players.

1.5 Delimitation of the Study

This study will be delimited as follows:

- This study will be delimited to the school going boys age ranged from 14-16 years.
- Although there are several factors involved for enhancement of cricket performance, the present study will be delimited to certain psycho-physiological parameters required for the cricket players.

1.6 Significance of the Study

- The study may bring an outstanding result showing improvement in the performance in Cricket, which is a challenging popular sport.

- Cricket players at national and international level may be benefited through result of this study.

- The newly designed yoga meditation program may be included during off season in Indian cricket players for maintaining skills.

1.7 Operational Definitions of Important Terms Used

Yoga practices

Yoga is an Indian philosophy, which has been proved as a scientific discipline for enriching state of self-realization in bringing psycho-physical homeostasis. However, yoga practice is a system of systematic practice of different kinds of posture (Asanas), breathing (Pranayams) and meditation (Dhyana) which primarily aims at providing health and physical fitness at psycho-physiological level.

Yoga meditation

Meditation is a precise technique for resting the mind and attaining a state of consciousness that is totally different from the normal waking state.

Heart rate variability

Heart Rate Variability is a measure which indicates the variation in heartbeats within a specific timeframe. The unit of measurement is milliseconds (ms).

Sleep quality

Sleep quality is defined as one's satisfaction of the sleep experience, integrating aspects of sleep initiation, sleep maintenance, sleep quantity, and refreshment upon awakening.

Stress recovery

Regular recovery is necessary for physiological systems to overcome the effects of stress. Recovery means reduced activation levels in the body in the absence of internal and external stress factors. During recovery, parasympathetic (vagal) activations dominate the autonomic nervous system and psychophysiological resources are restored.

2.0 BRIEF OF REVIEW OF LITERATURE

A sincere and exhaustive attempt has been made by the researcher to locate the relevant and useful studies. The findings and conclusion of these studies have been carefully extracted and cited below.

Studies investigating determinants of ball release speed have examined the technique and anthropometry of fast bowlers with little work being done on muscular strength. The aim of this study conducted by Loram *et al.,* (2005) was to determine whether knee biomechanics during bowling and strength of the shoulder and knee could predict ball release speed. Twelve cricketers, aged 16.6+/-0.7) years, from schools in Johannesburg, South Africa, volunteered for the study. Subjects were fast-medium bowlers (mean ball release speed of 29.2+/-1.8 m.s(-1)) and had been bowling for at least 5 years. Three accurate deliveries were filmed on an outdoor cricket pitch, in the sagittal plane with a high-speed digital camera recording at 250 frames per second. The mean ball release speed, knee angle at ball release and knee angle at front foot strike were determined using simple two-dimensional kinematics. On a separate day, peak concentric isokinetic muscle torque was measured for both knees and the dominant shoulder. Ball release speed was positively correlated to a straight knee at front foot strike (r=0.72, P=0.009) and at ball release (r=0.71, P=0.011).

No significant correlation was found between ball release speed and any of the peak torque values (knee extension peak torque, r=-0.11, knee flexion peak torque, r=-0.08, shoulder internal rotation peak torque, r=0.21 and shoulder external rotation, r=0.29, P>0.05). A multiple regression model using knee angle at front foot strike and at ball release, and the angle at which peak torque is generated during shoulder internal and external rotation, predicted ball release speed (adjusted r2=0.85, P<0.002). From the results it was confirmed that the angle of the front knee at the beginning and end of a delivery is an important correlate of ball release speed in schoolboy fast-medium bowlers. In addition we have also demonstrated that a multiple regression model based on knee kinematics and shoulder peak torque angles can be used to predict ball release speed.

Roca, Elliott, Alderson and Foster (2006) conducted a study with the aim to examine the relationship between shoulder alignment and elbow angle during the delivery action of fast-medium bowlers. The elbow and upper trunk alignment were recorded for 13 high-performance bowlers (mean age 20 years) using a 12-camera Vicon motion analysis system operating at 250 Hz. The three highest velocity trials for "good" and "short" length deliveries were analysed. Results showed that bowlers with a more front-on shoulder alignment at back-foot impact and when the upper arm was horizontal to the ground experienced a significantly greater elbow flexion--extension range when compared with those who had a more side-on orientation at the same point in the delivery action. Bowlers with greater shoulder counter-rotation also recorded higher elbow flexion and subsequently extension during the period from upper arm horizontal to ball release. Shoulder alignment and elbow angles were similar for "short" and "good" length deliveries. It was concluded that bowlers with a more front-on shoulder orientation at back-foot impact demonstrated a higher elbow extension from upper arm horizontal to ball release and are therefore more likely to infringe International Cricket Council elbow tolerance levels, compared with those who adopt a more side-on shoulder orientation at back-foot impact.

Fast bowling in cricket is an activity that is well recognized as having high injury prevalence and there has been debate regarding the most effective fast bowling technique. Therefore, Ranson*et al.,*(2009) determined whether two-year coaching interventions conducted in a group of elite young fast bowlers resulted in fast bowling technique alteration. Selected kinematics of the bowling action of 14 elite young fast bowlers were measured using an 18 camera Vicon Motion Analysis system before and after two-year coaching interventions that addressed specific elements of fast bowling technique. Mann-Whitney tests were used to determine whether any changes in kinematic variables occurred pre- and post-intervention between those who had the coaching interventions and those who didn't. The coaching interventions, when applied, resulted in a more side-on shoulder alignment at back foot contact (BFC) ($p = 0.002$) and decreased shoulder counter-rotation ($p = 0.001$) however, there was no difference in the degree of change in back and front knee flexion angles or lower trunk side-flexion. This study has clearly shown that specific aspects of fast bowling technique are changeable over a two-year period in elite level fast bowlers and this may be attributed to coaching intervention.

Duffield, Carney and Karppinen (2009) investigated the relationship between physiological and performance responses during repeated 6-over fast-bowling spells. Six, first-class, medium-fast bowlers performed 2x6-over spells separated by 45 min of light activity. The 6-over spells were based on the Cricket Australia fast bowling skills test that is a set order of deliveries at a grid-based target. Ball speed, accuracy and full and final 5-m run-up speed were measured on each ball. Nude mass, heart rate, core temperature, capillary blood lactate, pH and glucose, perceptual measures of RPE and muscle soreness (MS) and repeated vertical jump efforts were measured prior to, during and following each spell. Results indicated no decrement ($P=0.41$) and small effect sizes ($d<0.2$) in bowling speed (125.7+/-5.1 and 125.4+/-4.5 km.h(-1)) or accuracy (40.4+/-16.1 and 41.6+/-18.0 AU) between spells 1 and 2. No differences ($P=0.6$-0.8) were present between spells for heart rate, core

temperature, lactate, pH, glucose, RPE, MS or vertical jump. Only final 5-m run-up speed showed a large correlation with ball speed (r=0.70), while accuracy and speed were not correlated (r=0.05). In conclusion, repeated 6-over spells in well-trained bowlers results in minimal performance decrement in mild conditions (22 degrees C). As faster bowlers had faster final 5-m run-up speeds, the maintenance of high final 5-m run-up speeds might be important to maintaining bowling speed. Future research should also include a third bowling spell and warmer environmental conditions.

The objective of a study conducted by Dennis *et al.,*(2008) was to identify risk factors for injury to cricket fast bowlers using field-based tests. Ninety-one male adolescent and adult fast bowlers (aged 12-33 years) were participated in this study. Assessment of risk factors: A field-based pre-participation screening, consisting of musculoskeletal, fitness and anthropometric assessments and analysis of bowling technique was undertaken. Bowlers were prospectively monitored over the 2003-4 season and bowling workload and injuries were recorded. Logistic regression was used to identify injury risk factors. Main outcome measurement: Repetitive microtrauma injury to the trunk, back or lower limb associated with fast bowling. Two variables were identified as independent predictors of injury in the multivariate logistic regression analysis. Bowlers with hip internal rotation of < or =30 degrees on the leg ipsilateral to the bowling arm were at a significantly reduced risk of injury (OR 0.20, 95% CI 0.06 to 0.73) compared with bowlers with >40 degrees of rotation. Bowlers with an ankle dorsiflexion lunge of 12.1-14.0 cm on the leg contralateral to the bowling arm were at a significantly increased risk (OR 4.03, 95% CI 1.07 to 15.21) than bowlers with a lunge of >14 cm. Bowlers with a lunge of < or =12 cm were also at an increased risk, but not significantly so (OR 1.38, 95% CI 0.40 to 4.84). Biomechanical research is needed to investigate how these two intrinsic risk factors increase injury risk so that appropriate interventions can be developed.

Taliep, Prim and Gray (2010) determined if upper body muscle strength (as measured by the 1 repetition maximum bench press) was associated with cricket batting performance. Cricket batting performance was defined by the maximum hitting distance during a batting task and batting average and strike rate during 1-Day and Twenty/20 (T/20) matches. Eighteen, provincial level, elite cricket batsmen participated in the study. Upper body muscle strength was found to be positively correlated with maximum hitting distance ($p = 0.0052$). There were no significant correlations between upper body strength, batting average, and strike rate for both the 1-Day and T/20 matches. The results of this study have implications for coaches choosing a particular batting line-up. Batsmen who have stronger upper bodies could be favored to bat when a match situation requires them to hit powerful strokes resulting in boundaries. However, coaches cannot use upper body strength as a predictor of overall batting performance in 1-Day or T/20 matches.

Petersen *et al.,*(2010) compared the movement patterns of cricketers in different playing positions across three formats of cricket (Twenty20, One Day, multi-day matches). Cricket Australia Centre of Excellence cricketers (n = 42) from five positions (batting, fast bowling, spin bowling, wicketkeeping, and fielding) had their movement patterns (walk, jog, run, stride, and sprint) quantified by global positioning system (GPS) technology over two seasons. Marked differences in movement patterns were evident between positions and game formats, with fast bowlers undertaking the greatest workload of any position in cricket. Fast bowlers sprinted twice as often, covered over three times the distance sprinting, with much smaller work-to-recovery ratios than other positions. Fast bowlers during multi-day matches covered 22.6 +/- 4.0 km (mean +/- s) total distance in a day (1.4 +/- 0.9 km in sprinting). In comparison, wicketkeepers rarely sprinted, despite still covering a daily total distance of 16.6 +/- 2.1 km. Overall, One Day and Twenty20 cricket required approximately 50 to 100% more sprinting per hour than multi-day matches. However, multi-day cricket's longer duration resulted in 16-130% more sprinting per day. In

summary, the shorter formats (Twenty20 and One Day) are more intensive per unit of time, but multi-day cricket has a greater overall physical load.

Stuelcken, Ginn and Sinclair (2008) conducted a study to determine the career history of low back pain (LBP) in current elite female cricket fast bowlers and then compare measures of lumbar spine and hip range of motion (ROM) and trunk extensor endurance between those bowlers with and without a history of LBP. Measures for the female bowlers were also compared to a small sample of male fast bowlers. Twenty-six elite female fast bowlers and eight male fast bowlers of similar age and bowling experience were participated in this study. The career history of LBP was determined by a self-administered questionnaire and by accessing medical records. Range of motion measures for the lumbar spine and hips were obtained using inclinometry or goniometry. Trunk extensor endurance was assessed using a modified Sorensen test. Fourteen female fast bowlers had a history of LBP. There was a significant difference in lumbar lateral flexion ROM to the bowling arm side between those female fast bowlers with and without a history of LBP ($p < or = 0.05$). The female fast bowlers had significantly more bilateral hip extension ROM ($p < or = 0.05$) compared to the male fast bowlers. This information should be useful for practitioners involved in the conditioning and rehabilitation of cricketers. Future prospective studies should investigate potential predictors of LBP in female fast bowlers.

Dennis *et al.,*(2004) examined the relationship between the bowling workload of first-class fast bowlers and injury with the aim of identifying a "safe" fast bowling workload threshold. Twelve male fast bowlers (mean age 25 years) from an Australian state cricket squad were observed for the 1999--2000 cricket season. Workload was quantified by examining fixture scorecards and conducting surveillance at training sessions. Injury data were obtained from Cricket Australia's Injury Surveillance System. The seasonal incidence of injury was high with seven bowlers sustaining nine injuries. Whilst injured bowlers did not tend to bowl a greater number of deliveries on the day of injury, a significant increase in deliveries per session was observed in the 8-21 days prior to the

date of injury (mean= 77) as compared with the rest of the season (mean= 60, p< 0.02). Bowlers with a weekly bowling workload above the mean of 203 deliveries were at an increased risk of injury (Risk Ratio (RR)= 6.0, 95% confidence interval (CI) 1.00-35.91). Those bowlers who bowled in five or more sessions in any 7-day period were also at an increased risk of injury (RR= 4.5, 95% CI 1.02 to 20.12). A consistent relationship between high bowling workload and injury was observed. The risk of injury was much higher for those bowlers with a sessional, weekly and monthly bowling workload above the group mean, especially when this high workload was consistent and sustained.

Petersen, Wilson and Hopkins (2004) investigated the effects of training with overweight and underweight cricket balls on fast-bowling speed and accuracy in senior club cricket bowlers randomly assigned to either a traditional (n = 9) or modified-implement training (n = 7) group. Both groups performed bowling training three times a week for 10 weeks. The traditional training group bowled only regulation cricket balls (156 g), whereas the modified-implement training group bowled a combination of overweight (161-181 g), underweight (151-131 g) and regulation cricket balls. A radar gun measured the speed of 18 consecutive deliveries for each bowler before, during and after the training period. Video recordings of the deliveries were also analysed to determine bowling accuracy in terms of first-bounce distance from the stumps. Bowling speed, which was initially 108 +/- 5 km h(-1) (mean +/- standard deviation), increased in the modified-implement training group by 4.0 km x h(-1) and in the traditional training group by 1.3 km x h(-1) (difference, 2.7 km x h(-1); 90% confidence limits, 1.2 to 4.2 km x h(-1)). For a minimum worthwhile change of 5 km x h(-1), the chances that the true effect on bowling speed was practically beneficial/trivial/harmful were 1.0/99/< 0.1%. For bowling accuracy, the chances were 1/48/51%. This modified-implement training programme is not a useful training strategy for club cricketers.

3.0 METHODOLOGY

3.1 Sample

Sixty male school level elite cricket players (n=60), aged 14 to 16 years, will voluntarily participate in this controlled-experiment. All participants will be reported being healthy and free of medication, who shall be regularly active and meeting all the fitness requirement as elite cricket players. They will be selected by employing fisher's random table sampling technique. Making the use of table random numbers all the 60 players will be divided randomly into two matched groups viz., group –A (Experimental group) and group-B (Control group). Thus, each group will consist of 30 subjects.This investigation will be reviewed and approved by a Clinical Board of Ethics.

3.2 Research Design

Three experiments have been planned for a macro cycle of periodization for 9 months duration as follows:

- **Experiment-I**: This will be conducted for 3 months duration separately during pre-season.

- **Experiment-II** This will be conducted further for 3 months duration separately during competition-season.

- **Experiment-III** This will be conducted for 3 months duration separately during off-season.

Thus, total duration of whole experiment will be of 9 months. Every experiment will be conducted in three phases:

- Baseline / Pre Test;
- Treatment / Training, and
- Post Test.

The experiment-wise details of three phases are given below –

3.3 Design of Experiment-I(Pre-season phase):

This experiment will be conducted during *preparatory phase* of Macro cycle for 3 months. There will be two groups – one experimental group (n1=30) and one control group (n2=30). Three variables (heart rate variability, sleep quality and stress recovery) will be assessed to record baseline (pre-test) data. The experimental group will then participate in the scheduled cricket training for 2 hrs. daily (4:15 p.m. -6:15 p.m.) with an additional training of yoga meditation (45 mins. daily i.e., 6:15 p.m.-7:00 p.m.) for a total period of 3 months. However, the control group will participate in the scheduled cricket training for 2 hrs. daily like the experimental group, but will not participate in the yoga meditation programme, but will be involved in some recreation activities for 45 minutes. It should be noted that the above training will be imparted daily except Sundays and holidays. After the training period is over, both the groups will be post tested with the same three variables like pre-test (Table 1).

Table 1
Schematic representation of the design of Experiment-I
(during preparatory phase / pre-season period of 1st3-month)

<table>
<tr><th>Baseline</th><th>Training (Preparatory / pre-season phase)</th><th>Post test</th></tr>
<tr><td>Day 1</td><td>90 days</td><td>Day 1</td></tr>
<tr><td>Heart rate variability</td><td rowspan="3">Exp. Gr(n1=30).:
Cricket training + Yoga meditation

Cont. Gr.(n2=30):
Cricket training + Recreation</td><td>Heart rate variability</td></tr>
<tr><td>Sleep quality</td><td>Sleep quality</td></tr>
<tr><td>Stress recovery</td><td>Stress recovery</td></tr>
</table>

3.4 Design of Experiment-II (Competition-season phase):

After the experiment-I is over, the same subjects with same group will move for 2nd phase of experiment i.e., experiment-II. This experiment will be conducted during *competitive phase* of Macro cycle of next 3 months. There will be same two groups – one experimental group (n1=30) and one control

group (n2=30). Three variables (heart rate variability, sleep quality and stress recovery) as post-tested in experiment-I will be treated as baseline (pre-test) data for this experiment-II. During this phase, the experimental group will then participate in the competitive cricket on the scheduled dates of competition. Rest of the days during this 3 month duration, the experimental group will practice yoga meditation for 45 minutes only. However, the control group will also participate in cricket competition and rest of the days they will be involved for 45 mins of recreation programme (Table 2).

Table 2
Schematic representation of the design of Experiment-II
(during competitive phase / Competition-season period of 2nd3-month)

Baseline	**Training** (Competitive phase)	**Post test**
Day 1	90 days	Day 1
Heart rate variability	**Exp. Gr.** (n1=30)**:** Cricket Competition +Yoga meditation.	Heart rate variability
Sleep quality	**Cont. Gr.**(n2=30)**:** Cricket Competition + Recreation.	Sleep quality
Stress recovery		Stress recovery

3.5 Design of Experiment-III (Off-season phase)**:**

After the experiment-IIis over, the same subjects with same group will move for 3rdphase of experiment i.e., experiment-III. This experiment will be conducted during *transitional phase*(off-season) of Macro cycle of last 3 months. There will be same two groups – one experimental group (n1=30) and one control group (n2=30). Three variables (heart rate variability, sleep quality and stress recovery) as post-tested during experiment-II will be treated as baseline (pre-test) data for this experiment-III. The experimental group will then participate in the lead-up practice of cricket skills for 45 mins. daily (4:15 p.m. - 6:00 p.m.) with an additional training of yoga meditation (45 mins. daily i.e., 6:00 p.m.-6:45 p.m.) for a total period of 3 months. However, the control group will

participate in the said lead-up practice of cricket skills for 45 mins. daily like the experimental group, but will not participate in the yoga meditation programme, but will be involved in some recreation activities for 45 minutes. It should be noted that the above training will be imparted daily except Sundays and holidays. After the off-season training period is over, both the groups will be post tested with the same three variables like pre-test (Table 3).

Table 3
Schematic representation of the design of Experiment-III
(during transitional phase / Off-season period of last 3 months)

<table>
<tr><th>Baseline</th><th>Training (Competitive phase)</th><th>Post test</th></tr>
<tr><td>Day 1</td><td>90 days</td><td>Day 1</td></tr>
<tr><td>Heart rate variability</td><td rowspan="3">Exp. Gr. (n1=30):
Lead up practice of Cricket skills + Yoga meditation.

Cont. Gr. (n2=30):
Lead up practice of Cricket skills + Recreation.</td><td>Heart rate variability</td></tr>
<tr><td>Sleep quality</td><td>Sleep quality</td></tr>
<tr><td>Stress recovery</td><td>Stress recovery</td></tr>
</table>

3.6 Method of preparation of Training Interventions

Considering the design of three experiments, the investigator will prepare following four training interventions on the basis of the opinion of different experts and research literature too:

a) Cricket training programme:

b) Yoga meditation programme:

c) Recreation programme.

e) Lead up practice of Cricket skills.

3.7 Variables and Tools to be used

Considering the result of earlier researches, following three variables will be dealt with the experiment:

Sr. No.	Variables	Test / Tools	Criterion measures (nearest to)
1.	Heart rate variability	ECG/PPG	miliseconds
2.	Sleep quality	Questionnaire (Jafarian, Gorouhi, Taghva, &Lotfi, 2008)	± 1.0 point
3.	Stress recovery	Questionnaire (Davis IV, Orzeck & Keelan, 2006)	± 1.0 point

3.8 Assessment of variables

1) Assessment of heart rate variability

Heart rate variability will be assessed by recording ECG for five minutes. The RR interval will be used to calculate heart rate variability of participants.

2) Assessment of sleep quality

Each participant will be asked to complete the Groningen Sleep Quality Questionnaire (Jafarian, Gorouhi, Taghva, &Lotfi, 2008), a 15-item true or false questionnaire assessing sleep quality of the previous night with a maximal score of 14. A higher score is indicative of worse sleep quality.

3) Assessment of stress recovery:

To assess perceived balance between stress and recovery, participants are asked to complete the shortened version of the Recovery-Stress Questionnaire (Rest Q-Sport) consisting of 52 items, each to be rated by the individual on a 6-point scale. Ratings will be done based on the items focused on general and sport specific stress (26-items), as well as general and sport specific recovery (26-items). A total stress score and a total recovery score will

be calculated by the sum of the 26 stress-related-items and the sum of the total recovery score, respectively. More specifically, higher scores indicate a greater stress or a condition of greater recovery. A final score will be calculated by subtracting the total stress score from the total recovery score. A higher final score reflects a state of greater recovery.

3.9 Ethical Consideration

Informed consent of all the participants prior to the experiment will be taken with standard format (as per the Declaration of Helsinki). Further, permission from the Principal of the school will be taken before commencement of the experiment.

4.0 STATISTICAL TECHNIQUES TO BE USED

Primarily the data will be analyzed using descriptive statistics. Further, they will be processed through inferential statistics. In fact, for every experiment, the inferential statistics i.e., 2 x 2 x 3 factorial ANOVA followed by Scheffe's post hoc test will be employed for data analysis

(**Justification**: Group:2, Pre-post-: 2, & Variables: 3)

5.0 FACILITIES REQUIRED

- **Instruments:** Available.
- **Financial resources:** Available.
- **Man Power:**

  Some technical experts required for training in Cricket and yoga will be made available. In addition, the some technical assistants as may be required for data collection will be arranged as per requirement.

6.0 POSSIBLE OUTCOMES / CONTRIBUTION

Cricket is a competitive sport. Like every sport, the cricket players also face many psycho-physiological problems viz., disturbance in heart rate variability, changes in sleep pattern and delayed in stress recovery. Ample of earlier studies revealed that yoga and yoga meditation contributes to control many psycho-physiological problems of common people. This present investigation, therefore,may contribute to improve the functional ability of heart and sleep pattern in accelerating the stress recovery. This will improve the ability of the selected cricket players.

7.0 PLAN FOR WORK SCHEDULE TO COMPLETE THE PROJECT

WORK TO BE DONE	TIME TO COMPLETE
Preparation of research plan	02 months
Detailed review works	04 months
Preparation for experiment	06 months
Conducting Experiment	09 months
Data analysis	04 months
Writing research report	04 months
Research publication of 2 papers in UGC journals	06 months
Thesis submission	01 month

8.0 CHAPTERIZATION

While writing the report of the project, the researcher will consider the following chapters:

- **Preliminary pages**
- **Chapter – I:** Introduction.

- **Chapter – II:** Review of literature.
- **Chapter – III:** Methodology.
- **Chapter – IV:** Results and discussion.
- **Chapter – V:** Summary.
- **Bibliography**

9.0 REFERENCES

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